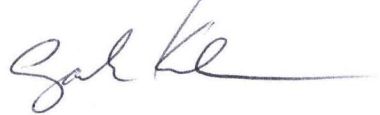


The Gift of Cycling

An Honors Thesis (HONRS499/EXSCI479)

by

Sarah Kehe

A handwritten signature in dark ink, appearing to read 'Sarah Kehe', with a long horizontal flourish extending to the right.

Thesis Advisor

David Poole

A handwritten signature in dark ink, appearing to read 'David Poole', with a large, stylized 'D' and a long horizontal flourish extending to the right.

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Abstract

Cycling has been used as a method of fitness improvement and maintenance, a mode of transportation, and as a social opportunity. I purchased my first bike online several years ago and have since had an increasing curiosity about riding. As I began looking for a 12 credit, 540 hour internship to meet the graduation requirements of Ball State's Exercise Science Department, I came across a golden opportunity. I accepted an internship with AeroCat High Performance Bicycles, LLC and have spent the summer learning about my new passion, cycling. My weekly reflections demonstrate the wide variety of experiences I have had, observations I have made, and lessons I have learned while working at AeroCat. Additionally, my internship required the submission of a paper on a topic agreed upon by my site director and advisor, Dave Poole, which I have included. My paper provides direction of the steps necessary to begin riding safely, demonstrates health benefits of cycling shown through studies done across the world, and shows what communities can to benefit local citizens in numerous ways by increasing bicycle programs and education.

Acknowledgements

I would like to thank Dave Poole for being my advisor for this project. He, along with his brother Tim, has provided me with the internship opportunity of a lifetime with AeroCat. It has been through them that I have had the means of learning about bicycles and made connections with other cyclists who were more than happy to share with me their expertise in a field that has become a significant part of my life.

I would also like to thank Dr. Stedman and my mother for not giving up on me and a special thanks to Jeff Frame in the Ball State Biomechanics Lab; I would have been completely lost without his direction.

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Part I: Reflections of My Summer Internship with AeroCat High Performance Bicycles, LLC.

AeroCat High Performance Bicycles LLC
1480 Tyson Road
Portland, IN 47371

May 17 – 23

In my first full week of interning with AeroCat, I experienced a small taste of some of the things I would be doing this summer. I learned the general structure of a work day and was introduced to the other employees. Dave and Tim Poole are the co-owners and president and vice president of the company respectively. Dan Hiller and Dave's son Isaac are the two mechanics who build, assemble, and occasionally repair AeroCat bicycles. I was briefly familiarized with several different types of bike races and physical design features of bicycles. I was also introduced over the phone to the leaders of some of the cycling teams that AeroCat sponsors.

My first phone conversation for the company was with Louie Amelburu, a cyclist for Barry Lasko, DDS cycling based in Las Vegas, Nevada. Establishing a relationship with him early on has allowed me to follow his team's results with ease and made it much simpler for me to gather information about Barry Lasko, DDS cycling and place it on the AeroCat website.

I was also introduced via telephone to Emile Abraham, who rides for the AeroCat Cycling Team, the team that receives the most from AeroCat in their sponsorship contract. Emile is originally from Trinidad and Tobago and he won a silver medal in the Pan American games several years ago. I quickly learned that it was difficult for me to understand him through the phone because of his thick accent and we began corresponding through e-mail.

My favorite part of my first week at AeroCat was traveling with Tim to the Geist Mini Marathon Expo in Fishers, Indiana and talking to people who were picking up their race packets. It was interesting to see that some people were very open about using cycling as a way of cross-training and others were avoidant of bicycles. I talked to several triathletes and established a connection with a young man that

later led to a sale.

Outside of working in the shop and the attending the expo, my first week at AeroCat involved me riding a bike for the first time in six months. I went on two rides with Dave, Tim, and Dan and I rode an AeroCat ACR500 that was built to be a demo bicycle.

May 24 – 30

Most of my time during my second week at AeroCat was spent creating a website for the AeroCat Cycling Team. The team consists of the following five men: Emile (previously mentioned), Juan Pablo Dotti, the two-time Under 23 National Champion from Argentina, Diego Garavito, a former Olympic mountain biker from Columbia, Daniel Asconeguy of Uruguay, and Andrew Crater, the only United States native. I enjoyed ‘brushing-up’ on my Spanish in order to correspond with some of the team members; and I used our correspondence to create pages for their race calendar, results, and individual biographies. It has been one of my tasks to update the team page regularly, and the current site can be viewed at <http://www.aerocatbike.com/AerocatTeamHome.html> .

Occasionally I would take a break from working on the computer, and in my second week at AeroCat, I watched the build-up and assembly of an entire bike. Dan put together an AeroCat R505 and did his best to explain things to me as he did them. I had a really difficult time following everything that he did because I did not know the names of all of the pieces he was assembling yet, and I was even worse at understanding the significance and purpose of certain parts in the first place. I began trying to tie what I was learning to topics within my major and started questioning how much exercise VO2max tests conducted on a cycle ergometer would differ if the machine was catered to a client as well as a high performance bicycle can be. If a 2.5 mm difference in length of a bicycle crank can make a significant difference to a rider, I imagine that setting someone up for an ergometer test and actually measuring them instead of ‘eye-balling’ a fit could make a significant difference for an experienced cyclist.

I expressed to Dave and Tim an interest in competing in triathlons early in the week and they agreed to build up a triathlon bike for me. The agreement was that I could use the bike this summer and

would not be obligated to buy it if I did not want to. Prior to this summer I had done five other triathlons and been relatively successful thanks mostly to my years as a competitive swimmer and runner. I was unsure of how motivated I would be to train without a swimming or cross country team for the first summer in eight years, but I was excited by the idea of making significant improvements on my previous bicycle times and started drafting a training program for myself. I swam 2,000 yards twice at Ball Pool at 6AM, went on three 25-30 mile bike rides, and did a 3, 4, and 5 mile run that week; together nearly a fraction of the training I would need to do to prepare to the Muncie Endurathon Half Ironman on July 10th which I had entered.

Dave gave me two books to read, *Cycling Anatomy*, a book of exercises and weight lifting exercising that benefit cyclists, and *Bicycle Design*, a sort of history of the bicycle and how it came to be what it is today. The first I hope to put into practice as I get more into cycling in the future and the latter was very useful in writing my research paper.

May 31 – June 6

After work on Tuesday, I drove with Dan to Marion and went on my first ever group bike ride. It is one thing to go on a nice hard ride by oneself or even with one or two other people, and it is completely different to ride with 30+ competitive cyclists and triathletes. Learning group etiquette is critical, and thankfully everyone riding was welcoming and forgiving of my inexperience. Riding in a large group makes maintaining high speeds relatively easy due to drafting, and it was frightening to ride a mere six inches behind the person in front of you while cruising down the road at 27mph. I was amazed at how quickly everyone could react to hazards and sudden directional and speed changes.

Being part of a group ride enabled me to observe some other cyclists, and many of them were willing to give me tips about what I could do to improve. I was given information about what type of cycling shoes to buy and some tips about body position to help me keep my back flat as I rode.

In the shop I had my first and only experience with pricing for AeroCat. I worked in Excel and updated price listings for bicycle components based on price changes that our distributors put into effect

at the first of the month. I was amazed at how expensive some parts are, and began to understand why high performance bicycles cost so much. The Excel spread sheet also helped me learn the differences between several main brands of parts and different lines within certain brands. One of the things about AeroCat that makes them unique is that bike parts can be custom ordered from differed lines and even different brands and interchanged in order to tailor to any performance or financial need.

June 7 – 13

In my fourth week at AeroCat, I observed my first bike fit. A customer came in and I watched as Dave took inseam, shoulder width, and other various measurements to help pre-set the bicycle. Dave spent quite a bit of time lining up the customer's shoes and cleats to ensure they would be comfortable and promote a high amount of power transfer to the pedals. Once everything was lined up, the bike the customer was purchasing was placed in a stationary trainer so it could be ridden in place. I listened to the comments Dave made and how the customer adjusted himself based on Dave's suggestions. The bike fit process was lengthy, and afterwards we (Dave, the customer, Dan, and myself) went on a 20 mile ride.

The real fun for me this week came at the end; I participated in two triathlons. On Saturday I competed in the AeroCat/Muncie Tri/Duathlon's Olympic distance race at the Prairie Creek Reservoir in Selma, Indiana and on Sunday I traveled to Bloomington to race the Hoosierman sprint distance. Racing back-to-back events is not a typical behavior for triathletes, but since adding the two races together would barely equal half of the Muncie Endurathon race, I thought it would be a good training tactic.

Because the triathlon bike I would be using for the Endurathon had not been completed, I used the AeroCat ACR500 I had been riding and put triathlon-specific handlebars called aerobars on it for the races. My swims and bikes were great, but in the Olympic distance race at Prairie Creek, my run did not feel very strong. I could tell that the time I was dedicating to cycling was taking a toll on my running training.

June 14-20

My fifth week at AeroCat was the first week I did not really experience anything new. The shop was really busy with customers coming to pick up bikes though, and Dave conducted numerous bike fits. I had finally reached the level where I was confident enough in what I had learned that I would offer input and try to ask thought provoking questions about form.

Riding with numerous customers this week also engrained in me that it is impossible to judge how good of a rider someone is based on their body type. I was notably outdone by a man I incorrectly assessed as not particularly 'fit' but was able to beat another man who had been riding for years and was dressed in some of the most expensive cycling gear on the market. My experience in other sports throughout the years should have prepared me for the break in the 'small, lean men make the best cyclists' stereotype, but I was still caught off guard.

June 21 – 27

What an amazing week! On Saturday Tim and I were the bike support team for the Morse Park Triathlon in Noblesville, Indiana. I have never been too much of a mechanic, but I changed numerous tires for athletes who experienced a flat before the race. After working, I raced in the event and was the 2nd female finisher.

Despite the amount of fun I had on Saturday, it was incomparable to the enjoyment of Friday and Sunday. On Friday I met the five members of the AeroCat Cycling Team and traveled with Dave to Madeira, Ohio to watch them race in the professional division race of the Madeira Criterium.

Apart from watching the Tour de France on television and being a part of several triathlons, I had not ever had any experience with bike racing. Criterium style races involve a loop approximately a mile long (or shorter) and as many as several hundred riders. Every time the main pack of riders passed by at the Madeira Criterium, a strong breeze that almost knocked me off of my feet followed shortly after.

During races teams utilize their members' specific talents and follow predetermined plans regarding who will try to set the pace for the pack and who will draft and try to sprint away at the end of the ninety minute race. For the AeroCat Cycling Team at Madeira, it was Emile who was set up to win

and he finished third.

On Sunday I returned to Ohio for the Tour de Grandview in Columbus, the team's third race of the weekend. The course featured a huge uphill on the finishing stretch, and Andrew Crater won the race. Juan Pablo Dotti was fifth, and after three top-five finishes over the weekend was crowned the overall series champion.

I was able to practice a few of my lifeguarding skills when I helped bandage Emile before Sunday's race in order to cover the huge road rash marks he merited in the final stretch of Saturday's race when another rider cut him off while going about 40 mph.

Watching the races maybe me wonder why I had never seen or heard of any cycling events growing up, and made me want to look into getting my racing license.

June 28 – July 4

In my seventh week at AeroCat, I was directed to focus on preparing some frames to be built up. AeroCat triathlon bicycles and any bikes that are custom painted require a large quantity of additional preparation time. Frames must be sanded down, painted with a base coat, have custom designed decals printed and applied, then be painted with a clear coat and baked. Most of my time was spent on working with bike decals, and it did not take long for me to realize how tedious and difficult it was to apply a decal perfectly in a specific place with no air bubbles.

In preparation for the Endurathon, I finally managed a long run of 12 miles. The first week in July was definitely too late in the summer to have finally reached that landmark, but at least I managed it.

July 5 – 11

Early this week I met with Jeff Frame in the Ball State Biomechanics Laboratory. I brought the triathlon bike AeroCat had built up for me and played a 'client' in a professional detailed bike fit. Jeff did many of the same things Dave did for his bike fits, but also introduced several new ideas to me. Jeff's stationary trainer can be hooked up to a computer and measure a person's pedaling efficiency. When I

asked how pedaling efficiency could be measured, Jeff explained to me the physics behind pedaling and how the computer measured the strength and direction of the forces generated while a person pedals.

As part of my bike fit, Jeff also used lasers and a video camera to track my pedaling alignment. Additionally, he taped me performing several movements that tested my range of motion and a few stretches to demonstrate my flexibility (or lack thereof). These exercises are used to check for imbalances that may result in pain or injury if left uncorrected.

The main focus of this week for the company was the Muncie Endurathon and its corresponding expo on Friday. Dave sent me to the expo on Friday to set up and work the first shift while he stayed back at the shop to finish up some other business he was dealing with so I drove the company van from Portland to Muncie and set up the AeroCat display next to the Runners Forum (one of our dealers and partners in Indianapolis) area. I talked with numerous athletes about AeroCat and Saturday's race. Since most triathletes already own their own bicycles, not many people seemed interested in purchasing a bike, and since there were other vendors with bicycles at the expo, my time there was spent just increasing awareness of the brand name rather than establishing relationships strong enough to lead to an immediate purchase. I observed that as a company, AeroCat got more attention at the Geist Mini Marathon Expo simply because we were the only company there that had brought bicycles and although most runners are aware of cross training benefits, not many own a quality bike.

The race on Saturday was a very intense experience. Of all of the triathlons I have done, it was easily the most painful, and all because of the last leg, the run. I had the fastest swim time of all of the hundreds of racers, including the professional men, and a relatively fast bike. However, I took the race out too fast and I mentally lost control about three miles into the run and had to run-walk the remainder of the race. I finished in just over 5 hours, a good time for a female, but I felt embarrassed that my run was so terrible after having been a division one collegiate distance runner for four years. I know now for next year that you cannot underestimate the last thirteen miles of a 70.3 mile race.

July 12 – 18

Outside of my usual website upkeep, I spent time following several orders from start to finish. I was in-touch with AeroCat's sponsored teams, particularly the AeroCat Cycling Team as they traveled to the Chicago area for a week-long racing series. Later in the week I had my second sale, an AeroCat R350, to my mother.

On Saturday I witnessed my first Xterra triathlon, a more extreme version of a standard road triathlon commonly found locally. Xterra triathlons involve mountain biking and trail running, and although AeroCat does have a mountain bike frame, the company has elected to focus on road and triathlon bicycles once they sell out of their current stock of mountain bike frames.

July 19 – 25

This week was the first time that Dan, Isaac, and I were left to run the shop while Dave was out of town for a few days. The three of us, all under the age of twenty-five, practiced a great deal of double and even triple-checking each others' work since Dave was not around to give the final 'OK.' I spent more time in the shop's back room working on building bicycles than I usually do, and finally started to understand how and why certain parts are assembled in a particular order using a particular method.

I began working on completely reformatting the product page on the website in an attempt to keep up with name brand manufactures. I started with the page for the AeroCat T605, the triathlon bike, and will be continuing to work on the product page through the completion of my internship.

In all it was a successful week, and numerous bikes were able to be shipped out despite the fact that Dave was out of town.

Summary:

Interning at AeroCat has been an incredible experience. The more immersed in cycling I have become, the more I have wanted to learn more about it. I plan to carry the knowledge I have acquired through my experiences and tasks (including the following paper) with me to graduate school and hope to incorporate cycling and riding education in my future research.

Part II: Cycling as a Fitness and Multipurpose Outlet

With the Tour de France recently in the papers daily, the perception of cycling as sitting on an uncomfortable piece of metal creeping slowly along storefronts and country roadsides shifts to the thought of an intense sport where strong men cross entire country sides and mountains at thirty miles an hour. In truth, the term ‘cyclists’ includes everything from a person who rides a bike on a weekly two mile ride to Tour de France and ultra event racers, as well as everyone in between. Cycling has been demonstrated to be an excellent mode of cardiovascular exercise, comparatively inexpensive and environmentally friendly transportation, a social opportunity, and a way of exploring and learning about one’s surroundings.

Before purchasing a bicycle and accessories, it is imperative to evaluate what type of riding you plan on getting into. Are you purchasing a bike to commute to work daily? Do you plan on racing road and criterium races? Do you plan on cycling off-road? Are you thinking about time trials or triathlons? Are you just looking for a campus cruiser bicycle? Knowing what you plan on using a bicycle for can help you decide what type of bicycle will best match your needs.

Bicycle frames are generally made from one or more of several metals; steel, aluminum, titanium, and carbon fiber. Up until the late 1970’s, steel frame bikes were most commonly available and although they are still available today, they are extremely heavy compared to the frames constructed from aluminum, titanium, and carbon fiber. In today’s market, more expensive road racing bicycles produced by the world’s best-known brands have a carbon

composition, which gives them more flex for comfort as well as high stability and a light weight.

(1)

After a bike frame is chosen, the next step is selecting components for a bicycle. Most bicycles are purchased completed, that is, with a given set of components. Bicycle components generally are a much larger portion of a bicycle's price than the frame, and if the frame is not made of steel, the components can often add to be the majority of a bicycle's weight. Asking a trustworthy bike shop employee about specific brands and lines of components is a good way to ensure the purchase of a bicycle that will provide a more comfortable and efficient ride and will require less maintenance and less frequent adjusting. For cyclists not looking to race or complete ultra events, less expensive parts are often the best option. However, for riders who wish to train and compete at high levels, more expensive parts crafted from carbon fiber for its light weight property are usually preferred.

Once a bicycle frame and components are purchased, the next step is accessorizing. Trek's 1 World 2 Wheels website has a video listing several practical safety and comfort promoting items. First and foremost is a helmet. Helmet use is the best way to prevent any serious head injury resulting from any crash or fall and a helmet should be worn on every ride. Helmets should be inspected for cracks prior to every ride and should fit snugly over the head and across the middle of the forehead in the front. Most safety studies conducted in North America have focused mainly on helmet design. Although helmets are the key piece of safety equipment for head injuries, it is important to remember that they do not aid in the protection of the rest of the body and they do not prevent crashes and falls from happening. (11)

Apart from helmets, if a cyclist has elected to have specific pedals on their bike, they will have to purchase corresponding cycling shoes. Cycling gloves are not necessary for bicycle

safety, but many riders opt to have them because the gel in the palms reduces road vibration in the hands and up the arms while riding. Pant straps are cheap, efficient Velcro straps or metal clasps used to keep pant legs from catching on the bicycle chain and cassette. For anyone cycling in loose pants, such straps are a type of safety device. Apart from protecting the eyes from the glare of the sun, sunglasses are used to keep debris and bugs out of a rider's eye. Seat packs can be used to keep gear needed to change a flat tire (a spare tube, tire levers, and an air cartridge) as well as provide storage for keys and a cell phone. Other important safety devices between dusk and dawn are lights and reflectors, which enable cars and other traffic to see a cyclist and alert cyclists to dangers ahead. Also, before departing for a ride, a cyclist should ensure they have enough water with them or have a route that will allow them to rehydrate along the way. (2)

Once a bike and all of its accessories have been purchased, it is highly recommended to complete a professional bike fit. The local SICI (Serotta International Cycling Institute) certified bike fitter is Jeffrey Frame in Ball State's Biomechanics Laboratory. Going through a full bicycle fit can take several hours and is an extremely detailed process. A sort of health history questionnaire is filled out and cycling history information and goals are exchanged prior to preliminary measurements of the rider, their bicycle, and their equipment. A video from front and side angles is then usually taken while the bicycle is ridden in a stationary trainer that enables the cyclist to pedal at a constant watt producing speed and load. While the cameras are rolling, lasers can be set up and used to check body alignment over the course of a pedal stroke. Upon completion of recording, the video can easily be analyzed on a large monitor computer screen and a fitting expert can usually already have numerous ideas on what to change. Before many adjustments and suggestions are made, the cyclist being fitted may be asked to perform several exercises that allow the fitter to determine range of motion, flexibility, balance, and even

strength of the rider. Some of the movements resembled movement patterns used in the FMS (Functional Movement Systems) screening that the Ball State Strength and Conditioning Program uses to assess athletes. After more measurements are made, the adjusting begins. Shoes and corresponding cleats alone require much attention in order to be properly fitted. Many bike shoes do not cater to the foot's three arches so inserts or orthotics may be recommended for people who have any feet issues. After necessary adjustments are made to the shoes, the real challenge begins. The art of bike fitting relies heavily on basic geometry and physics principles and it is important to realize that with every adjustment, a measurement apart from the main one being changed is also effected. In fact, numerous measurements outside of the main thing being changed are altered. The four principal measurements for bike fitting (Figure 1) are the distances (in cm) from the top of the saddle to the center of the bottom bracket, the horizontal difference between the saddle tip and the center of the bottom bracket, the horizontal distance between the saddle tip to the center of the handlebars, and the height difference between the top of the saddle and the top of the handlebar stem, and they are all intertwined. Some adjustments may be significant enough to require that parts on a bike be exchanged for more appropriately fitting parts, but usually that can be avoided by making enough other adjustments that compensate for a specific problem. Once the bike has been properly reset, another video can be made and compared to the initial tape. If everything is looking and feeling good, the rider can take their bike outside for a genuine test ride. A good bike fitter will follow up with clients as they grow, gain experience, and go through different parts and bicycles. (3)

There are numerous opportunities locally and nationwide designated to help new cyclists develop into safe, educated riders. In east central Indiana organizations including the Delaware County Cycling Club, East Central Indiana Endurance, and Cardinal Greenways are working to

promote cycling and cycling education. In its mission, the Cardinal Greenway states, “Cardinal Greenway is dedicated to enhancing the quality of life by developing and operating corridors and trails to connect people and communities” and its core values include stewardship, volunteers, wellness, accessibility, community enhancement, learning, collaboration, cultural appreciation, and environmental sensitivity. (4) In addition to professionally organized groups, many bike shops schedule group rides on a weekly basis that depart from their shop and are open to different levels and types of riders.

Events like the 31st Muncie Endurathon on July 10, 2010, Tour de Muncie on July 24, 2010, The 10th Annual Great Greenway Tour on July 31, 2010, and several triathlons at the Prairie Creek Reservoir have all brought attention to the cycling capabilities of Muncie and its surrounding regions.

By focusing on the many health benefits and community enhancement aspects of cycling, local groups and events have been able to generate a sustaining interest in the community about biking. Currently however, cycling remains more popular in European nations and a significant percentage of cycling health research is conducted outside of the United States. There is a much higher risk of injury associated with cycling in North America than in Europe. (11)

Studies have found that cycling is good for the body in numerous ways and can be used as a weight loss tool or a supine mode of exercise used to prevent deconditioning of the cardiovascular system when a patient is restricted to bed rest. A study held at the Department of Sports Science at the University of Palermo, Italy found that after a specific 12 week indoor cycling training session, sedentary women had 3.2% reduction in body weight, 5% loss in fat mass, 2.6% increase in lean body mass, 9% decrease in resting heart rate, 8.6 Watt power output increase, and a .5ml / kg min training O₂ uptake increase. This study was done without placing

any dietary restrictions on the women being tested, and even the freedom to increase food intake as a result of energy expended during cycling sessions was not enough for them to gain or maintain their previous sedentary weights. The study concluded that an indoor cycling protocol might be a sufficient way of preventing an increased risk of cardiovascular disease and is a method of improving cardio-respiratory fitness among sedentary women. It was also concluded that there is a significant importance to be placed on the cycling protocol used to ensure that the program length and intensity cater to the health status of the subjects involved. (5)

Another study, conducted in Texas in March, 2010 showed that supine cycling during bed rest and dextran infusion post-bed rest prevented atrophy of the cardiovascular system. Twenty-one participants, eighteen male and three female, were restricted to bed rest in the 6 degree head-down tilt for 18 days. Fourteen of the subjects were permitted to do supine cycling exercises while the other seven did no exercise. After 18 days, all of the subjects who did not exercise and half of those who did were given dextran infusions to assist with cardiac filling, dividing the participants into 3 test groups. Daily supine cycling alone was enough to preserve vertical exercise capacity and left ventricular mass and distensibility. Lower body negative pressure tolerance and dextran infusion alone following bed rest without exercise did no measurable amount of preservation. The study concluded that along with a restoration in plasma volume, daily supine cycling can prevent cardiac deconditioning and orthostatic intolerance following bed rest. (6)

One problem that some people have with cycling is that it is not a load-bearing, feet pounding exercise like running, so it may not seem as strong of a method of preserving bone mass and density. A study conducted in March of 2009 in Manchester, United Kingdom, found that distance cyclists, and sprint cyclists to an even higher degree, have greater tibia and radius

bone strength than their sedentary counterparts. Even with age, cyclists had well preserved tibial strength and density. The study concluded that among men, competitive cycling and its associated training is an excellent method of preserving average, or if not above average bone strength into old age. (7)

People who begin a cycling program for the first time would not be the only ones who would physically benefit from their cycling; increased cycling rates have been correlated to decreased injury rates among cyclists. (11)

Apart from being strictly beneficial to health, cycling can serve as an excellent mode of transportation. A 2008 study conducted in Canada evaluated whether or not active commuting (ie cycling or walking) would help solve the current obesity epidemic. It was noted that while kids and teenagers enjoyed cycling, adults were more likely to walk due to safety concerns and issues relating to bike storage and work dress codes. In the end it was observed that cyclists had a more significant decrease in cardiovascular mortality than walkers did, but overall results about solving the obesity issue were fairly inconclusive. More information is needed about how active commuting affects peoples' views about physical activity and there needs to be a specific recommendation dose, effort, and duration of active commuting that is considered beneficial. The study also noted that better urban design and maybe educational programs to involve more of the sedentary population would produce better results as well. (8)

In order for people to be encouraged to change their habits and consider active commuting via bicycle, several problems need to be addressed by local governing bodies and employers. As the previous study mentioned, some adults were leery of commuting by bike due to issues with destinations not being bike-friendly. Bike-friendliness of communities can be evaluated on numerous levels, and the League of American Bicyclists has programs on their

website designed to help judge a community on bike-friendliness in the categories of engineering, education, encouragement, enforcement, and evaluation. The LAB now awards communities with four different award levels for bike-friendliness; platinum, gold, silver, and bronze. Cities that apply and are awarded receive local and national press at an awards ceremony. As of 2009, Boulder, Colorado, Davis, California, and Portland, Oregon were the only three cities to receive the platinum award. Nine cities met the gold standard, twenty met silver, and fifty-six cities, including Bloomington and Carmel representing Indiana, met the bronze standard. The LAB claims that special bike facilities not only aid with safe transportation, but provide places for recreation, help with storm water management, and assist with preserving better air quality. The government also saves by investing on trails. The cost of putting a cop in a cruiser is equivalent to the amount necessary to supply twenty officers with bikes. Also, savings on space and money to house bikes instead of cars in public garages reaches into the tens of thousands of dollars. (9) Increased cycling patterns would be worth four to five times the cost of investing in new cycling infrastructure for taxpayers. (11) As far as local economies are concerned, bicycling related excursions are the third most popular outdoor vacation activities in the US. Portland, Oregon, which has established itself as an example of a bicycle-friendly community, has a bike-related industry worth 90 million dollars and is responsible for over 800 jobs. Developing a bikeway network certainly does not happen overnight; but by building pathways, lengthening and connecting them, gradually a network is formed that could equal something as large as Portland's 260 miles of bikeway. (9)

In Sydney, Australia, a study was done to measure community response to the Cycling Connecting Communities Project. CCCP was designed to be an educational and opportunistic experience for everyone in the community, regardless of their previous cycling practice. Courses,

group rides, events, marketing, and map distribution were put into effect and pre and post-project phone survey and bike-counters on newly constructed paths were used to determine the effectiveness of the program. The telephone surveys were conducted two years apart and together with the bike-count data revealed that although there was a significant increase in cycling awareness and bike path use, population cycling levels remained relatively stable. However, the study's conclusion did mention "limited funding" as a probable cause for the lack of increase in population cycling. (10)

All in all, cycling is an excellent way to be physically active. It aids in heart and bone health and allows for better maintenance of a healthy body composition. There needs to be more funding directed to bicycle promotion and education across the continent in order to reduce injury rate and provide encouragement, knowledge, and support for people just starting to look at cycling. Bike riding is also a great mode of transportation that is environmentally friendly and the government and local employers should work to improve infrastructure and facilities that allow for a pleasurable daily commute. There are small bicycle communities and groups that can be accessed online and through local bike shops that provide information about how to get started on a bike; so what are we waiting for?



Figure 1:

The four critical bike fit measurements

Top of saddle to center of bottom bracket (red)

Saddle tip to center of bottom bracket (cyan)

Saddle tip to handlebars (lavendar)

Saddle to stem drop (yellow)

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